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IS 9283 (1995): Motors for Submersible Pumpsets [ETD 15: Rotating Machinery]

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(पहला पुनरीक्षण)

Indian Standard

MOTORS FOR SUBMERSIBLE PUMPSETS — SPECIFICATION

(First Revision)

(Second Reprint JULY 1999)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1995 **Price Group 7**

Rotating Machinery Sectional Committee, ETD 15

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Rotating Machinery Sectional Committee had been approved by the Electrotechnical Division Council.

This standard should be read in conjunction with IS 8034 : 1989 and IS 14220 : 1994 as the submersible motor and the submersible pump together form a complete set. Coordination in the selection of motor and pump with respect to their size, rating and output, etc, is necessary for satisfactory and efficient operation of the pump set.

The general requirements of 3-phase induction motors are covered in IS 325 : 1978 and requirements of single-phase motors are specified in IS 996 : 1979. The requirements of 3-phase squirrel cage induction motors for centrifugal pumps are covered in IS 7538 : 1975. The detailed procedure for conducting tests on motors are given in IS 4029 : 1967 and IS 7572 : 1974 as relevant.

In the first revision of this standard the following have been added:

i) preferred output rating of the motors;
ii) material for components of motors;
iii) performance characteristics of 3-phase induction motors;
iv) recommended proforma for preparing type test report; and
v) information to be given at enquiry and order.

Reference should be made to IS 10804 : 1994 for efficient pumping system design.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

MOTORS FOR SUBMERSIBLE PUMPSETS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard covers the requirements of submersible motors for bore hole and open well pumps handling clear, cold and fresh water at temperatures not exceeding 33°C.

2 REFERENCES

2.1 The Indian Standards given in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.0 For the purpose of this standard, the definitions given in IS 1885 (Part 35) : 1973 and the following shall apply.

3.1 Wet Type Submersible Motors

It is a motor which is completely filled with clear water or oil or emulsion of water and oil.

3.2 Resin Filled Submersible Motors

It is a motor, where stator is encapsulated and filled with an insulating compound. The remaining portion is filled with water or oil.

3.3 Sealed Sumbersible Motors

It is a motor, where winding as well as entire remaining space within the motor is filled with air or suitable grade of oil.

4 CHARACTERISTICS OF CLEAR, COLD, FRESH WATER

4.1 The clear, cold, fresh water shall mean water having the characteristics specified below:

a) Turbidity	50 ppm (silica scale), *Max*
b) Chlorides	500 ppm, *Max*
c) Total solids	3 000 ppm, *Max*
d) *p*H	6·5 to 8·5
e) Temperature	33°C
f) Specific gravity	1·004, *Max*

NOTES

1 If the range of *p*H value of the water pumped is between 6·5 and 7·5 and also the chlorides content is less than 100 ppm, the pump may be made of any bronze. However, if the range of *p*H is between 6·5 and 8·5 and the chlorides content exceeds 100 ppm, only zinc-free bronze fitted construction or stainless steel construction shall be permitted.

2 If any other characteristic of the water differ from those specified in **4.1**, the pump details shall be agreed between the manufacturer/supplier and the user, and shall be specified in the order.

5 CONSTRUCTION

5.1 The nomenclature of various components in the assembly of submersible pumpset is given in Figs. 1, 2 and 3. The typical submersible pumpset installation is given in Fig. 4 for information.

5.1.1 All the materials and components for the motors shall be suitable for application in respect of corrosion resistance and mechanical performance continuously under water. The typical materials used in the submersible motors are given in Table 1 for the guidance of the manufacturer and the user.

5.1.2 The rotor of the wet type submersible motor shall be provided with suitable epoxy paint to protect it from corrosion under water.

5.1.3 The thrust bearing housing shall be provided with a drain plug to empty the oil/pure water filled into the thrust bearing housing/ motor.

5.1.4 The motor shall be provided with a breathing attachment like bellows, diaphragm, etc, to compensate the volumetric variation of water inside the motor due to changes in the temperature.

5.2 Foreign Matter

The motor shall be protected by means of cable glands, rubber seals etc, from ingress of borewell water, sand and other foreign matter.

5.3 Recommendation for Selection of Submersible Cable

5.3.1 The cable shall be PVC insulated and PVC sheathed flexible 3 core flat type. The requirements of the flat cable shall be agreed between the manufacturer and the user. The size of the conductor shall be adequate and suitable for continuous use under water and in air.

5.3.2 The purchaser may specify the actual length of the cable required for the motor.

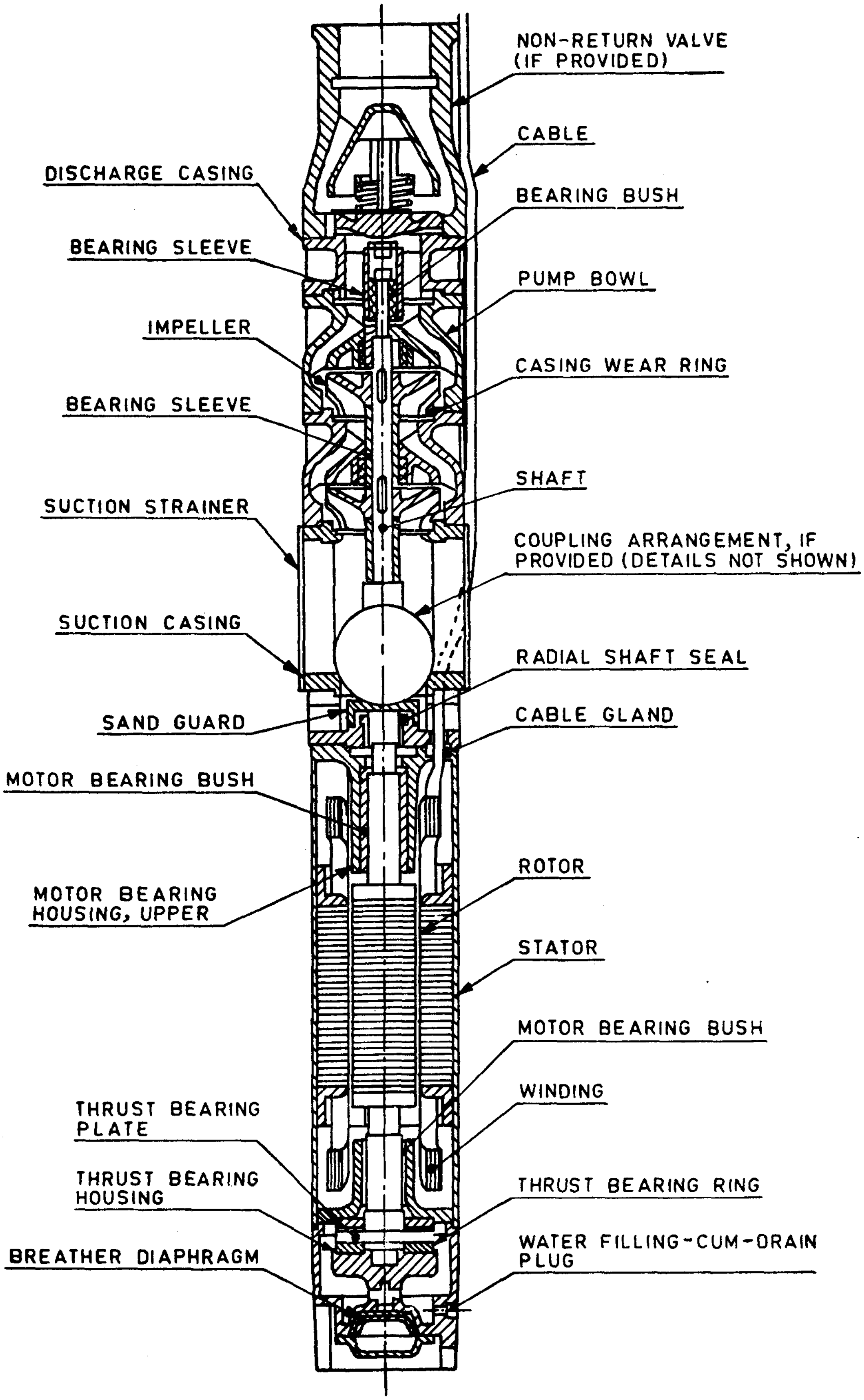


FIG. 1 WET TYPE WATER FILLED MOTOR

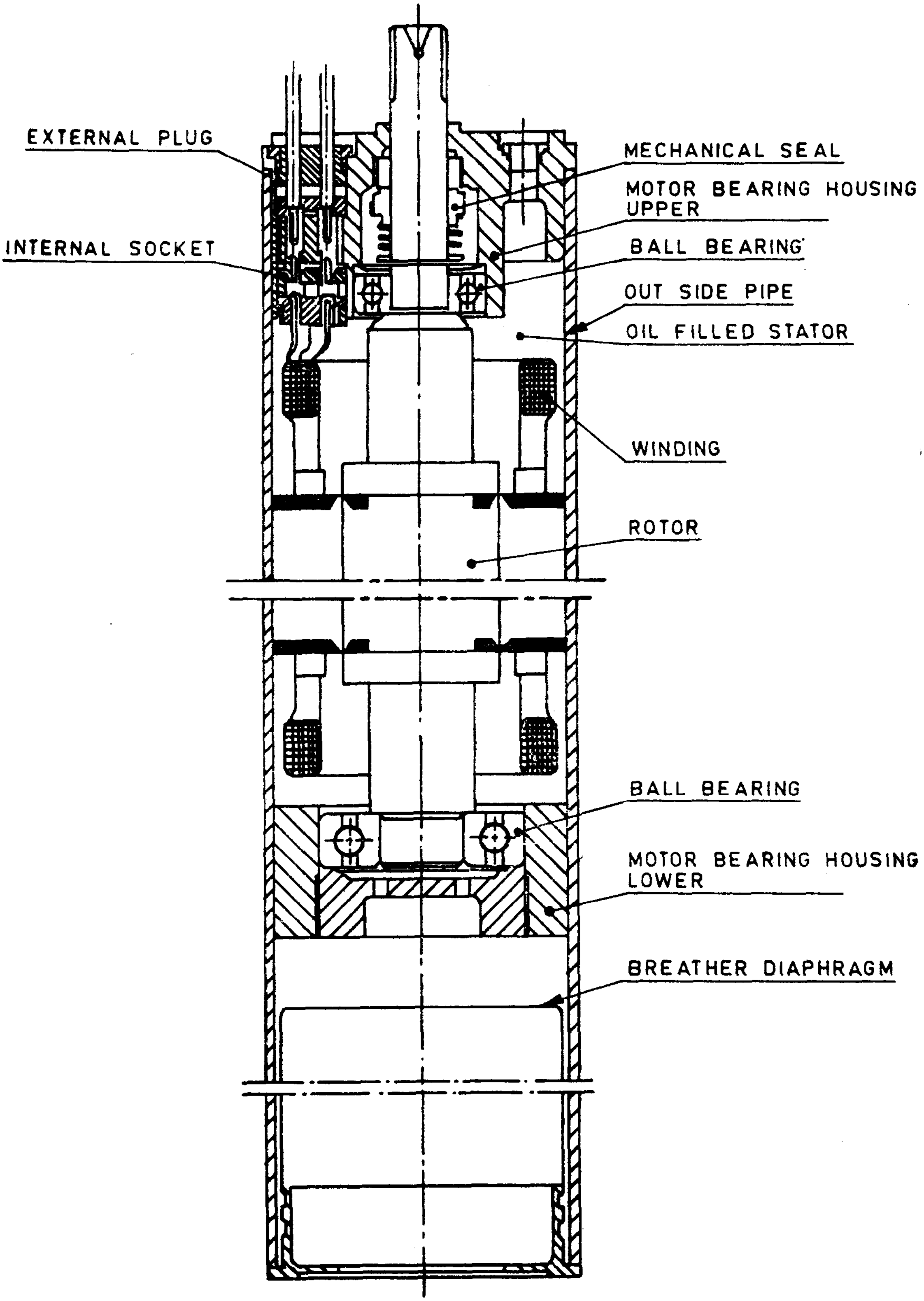


FIG. 2 WET TYPE OIL FILLED MOTOR

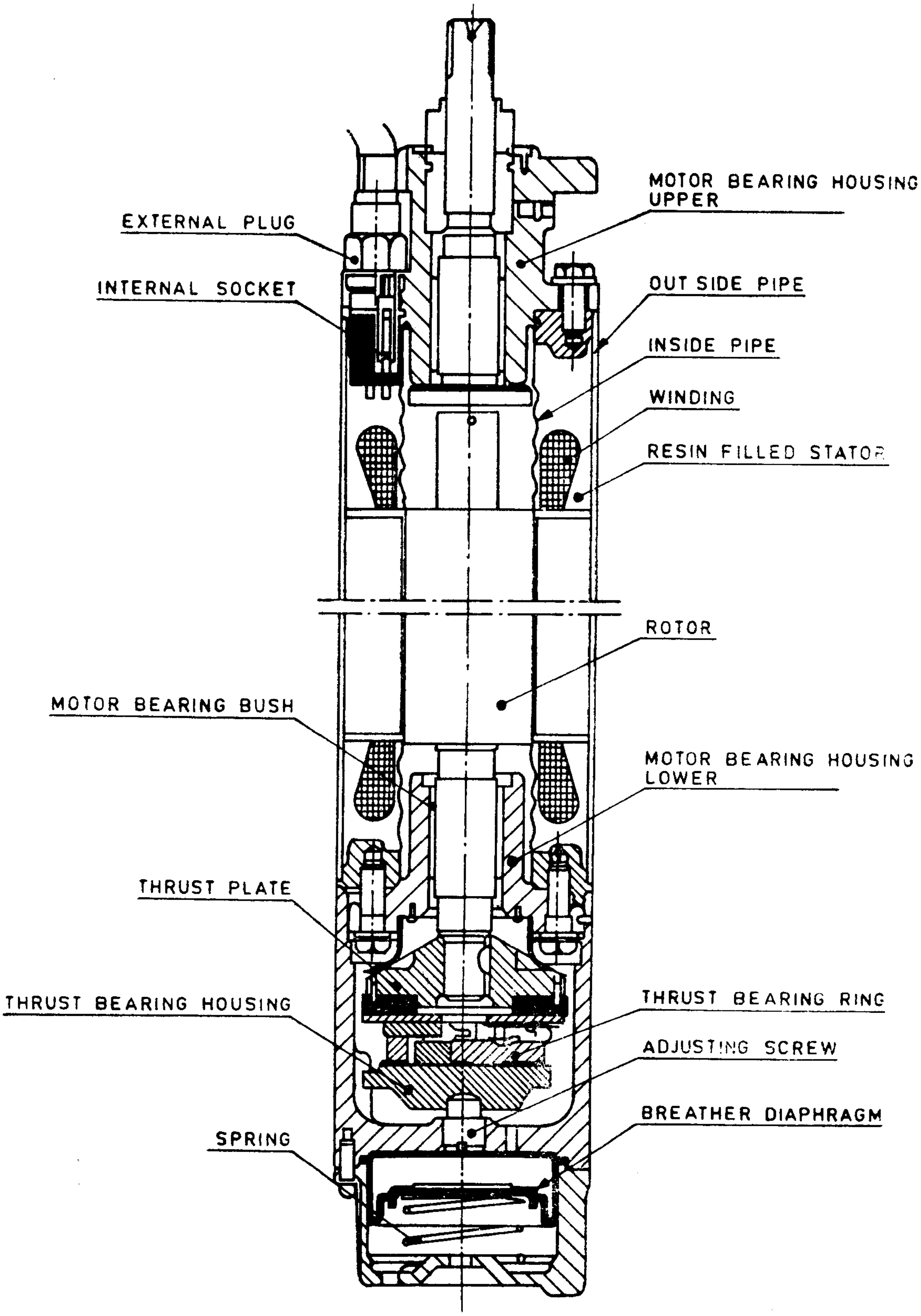


FIG. 3 RESIN FILLED MOTOR

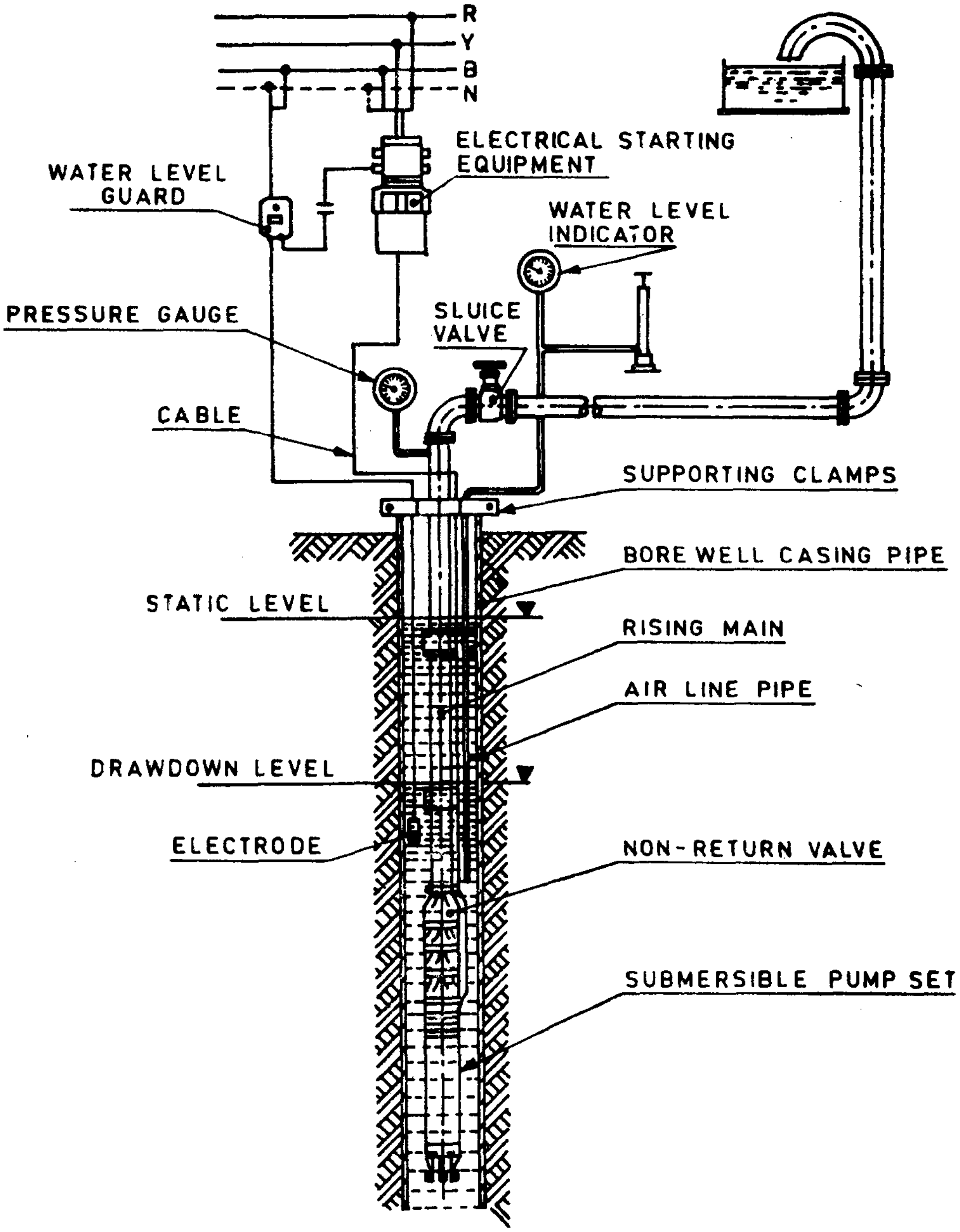


FIG. 4 TYPICAL SUBMERSIBLE PUMPSET INSTALLATION

In the absence of this information, the motor shall be supplied with a cable length of 3 m.

5.3.3 In case a joint is required to be made between the lead cable supplied with the motor and the user's cable connectors, a detailed procedure to make a water tight jointing shall be supplied by the motor manufacturer.

5.3.4 The size of the conductor and length of cable should be suitably selected so that the voltage drop at motor terminals does not exceed three percent of the rated voltage.

5.4 Earthing

5.4.1 Motor shall have suitable provision for earthing to facilitate earthing of the motor as per IS 3043 : 1987 at the time of installation.

5.4.2 In case GI pipes are used for the purpose of earthing the motor, earthing connection may be made to the discharge pipe clamps.

Table 1 Typical Materials for the Parts of the Submersible Motor

(*Clause* 5.1.1)

Sl No.	Name of the Part	Material	Indian Standard and Grade, if any
i)	Bearing housing and base	Grey cast iron	IS 210 : 1993, Gr FG-200
ii)	Motor shaft	Wrought steel or Chromium steel	IS 1873 : 1961, C40 IS 1570 (Part 5) : 1985 Gr 04 Cr 13, or 12 Cr 13, or 20 Cr 13
iii)	Bearing bush	Leaded tin bronze or Resin bonded carbon metal or Rubber or Rubber-lined	IS 318 : 1981, LTB 3 or LTB 4 or LTB 5
iv)	Rotor		
	a) Laminations	Electrical sheet steel	IS 648 : 1994
	b) Conductor core	Electro grade copper	IS 613 : 1984
v)	Stator	Die cast aluminium	
	a) Laminations	Electrical sheet steel	IS 648 : 1994
	b) Winding wire		
	1) Conductor	Electro grade copper	IS 613 ; 1984
	2) Insulation		
	i) For water filled motors	PVC or With polymer	IS 8783 : 1978
	ii) For dry or encapsulated or oil-filled or resin-filled motor	Super enamelled	Insulation details as covered in IS 4800 (Part 7) : 1970
vi)	Breather diaphragm	Nitrile rubber	
vii)	Thrust bearing	Vulcanized fibre *v/s* chromium steel or graphite *v/s* graphite or vulcanised fibre *v/s* bronze	
viii)	Cable gland	Nitrile rubber	
ix)	Cable		
	a) Conductor	Electro grade copper	
	b) Insulation	PVC or With polymer and/or sheathing	IS 694 : 1990
x)	Stator casing	Grey cast iron or Carbon steel (sheet or pipe) or Stainless steel sheet	IS 210 : 1993, FG 200 IS 1570 (Part 5) : 1985 Gr 20 Cr 13

NOTE — The materials indicated are typical. Manufacturers may use materials of properties superior as per the properties of the materials indicated.

5.5 Finish of Bearings

For motors having journal bearings, the surface of the rotor shaft or that of the sleeves when provided, shall have a surface roughness not higher than 0·75 microns Ra (*see* IS 3073 : 1967) at the journal bearing surface.

5.6 Balancing of Rotor

The rotor shall be dynamically balanced as per grade 6.3 of IS 11723 (Part 1) : 1992.

6 PREFERRED VOLTAGE AND FREQUENCY

6.1 Preferred Voltage

The preferred rated voltage shall be 415 V for three phase motors and 240 V for single phase motors (*see* IS 12360 : 1988).

6.1.1 *Preferred Frequency*

The preferred rated frequency shall be the standard frequency of 50 Hz.

6.2 Voltage and Frequency Variations

6.2.1 *Category 'A'*

The motors shall be capable of delivering rated output with:

a) The terminal voltage differing from this rated value by not more than ±6 percent,

b) The frequency differing from its rated value by not more than ±3 percent; and

c) Any combination of (a) and (b).

6.2.2 *Category 'B'*

The motor shall be capable of delivering rated output with:

a) The terminal voltage differing from this rated value by not more +6 percent and −15 percent;

b) The frequency differing from its rated value by not more than ±3 percent; and

c) Any combination of (a) and (b).

6.3 Preferred Output Ratings

The preferred output ratings in kW shall be:

Three phase motors: 0·75, 1·1, 1·5, 2·2, 3, 3·7, 4·5, 5.5 7·5, 9·3, 11, 13 and 15.

Single phase motors: 0·37, 0·55, 0·75, 1·1, 1·5, 2·2, 3 and 3·7.

6.4 Speed

The preferred speed shall correspond to 4 or 2 pole motors [1 500 and 3 000 rev/min (Synchronus)]

7 DIMENSIONS AND TOLERANCES

7.1 Dimensions of Motors

Preferred overall diameter of submersible motors covered in this standard are 96, 100, 142, 150, 192 and 200 mm (*see also* Table 2).

7.1.1 *Dimensions of Shafts of Submersible Motors for Borehole Pumps*

Recommended dimensions for shafts of submersible motors for borehole pumps are given in Fig. 5, 6 and 7.

7.2 Tolerances

7.2.1 For motors with anti-friction bearings, the accuracies of shaft extension runout, concentricity of mounting Mabbet and face runout, if not otherwise specified, shall be of normal class given in Table 6 and Table 7 of IS 2223 : 1983 for all sizes of submersible motors from 100 mm to 200 mm.

7.2.2 For motors with journal bearings, the face runout on the spigot shall not be more than 125 microns and eccentricity shall not be more than 100 microns. The method of measurement shall be as per Fig. 8.

8 DUTY AND TYPE

8.1 The motor shall be of continuous duty (type S1) specified in IS 12824 : 1989.

9 LIMITS OF TEMPERATURE RISE

9.1 The temperature rise of insulated windings of stator shall meet the requirements given in **19**.

10 OVERLOADS

10.1 The motor shall meet the requirements specified in **18**.

11 PERFORMANCE CHARACTERISTICS

11.1 The motors shall comply with the requirements given in **17**.

12 EFFICIENCY AND POWER FACTOR

12.1 Efficiency

The statement of efficiency at rated load of the motor shall be made by the manufacturer. The values for 2 pole motors shall not be inferior than those given in Table 2. The values of 4 pole motor are under consideration.

NOTE — For determination of efficiency of submersible motors by summation of losses method as outlined in IS 4029 : 1967, the stator I^2R shall be calculated using the value of resistance as at 50°C for motors wound with PVC insulation and as per IS 325 : 1978 for motors wound with enamelled copper wires.

12.2 Power Factor

If a statement of power factor of the motor is required, the purchaser shall specify at the time of enquiry. The tolerances on the declared values shall be applicable in accordance with IS 7538 : 1975, IS 996 : 1979 or IS 325 : 1978 as applicable.

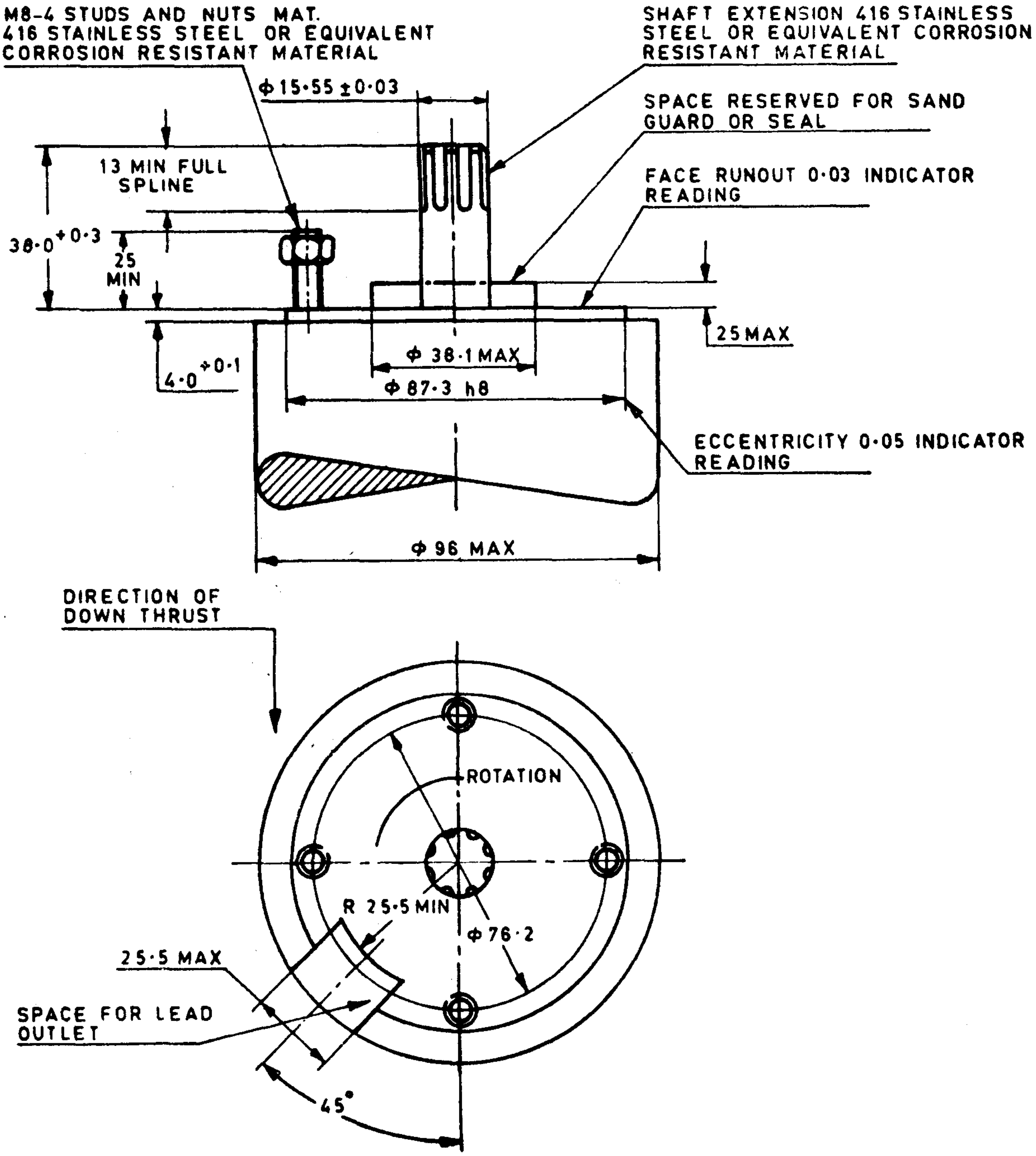
13 TERMINAL MARKINGS

13.1 The terminal markings or identification of lead wires shall be clearly given for proper connections to the supply system.

14 INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

14.1 The following general information may also be furnished when enquiring for and ordering the submersible motor, in addition to the information given in Annex A of IS 325 : 1978.

a) Level of water above the submersible motor, and


M8-4 STUDS AND NUTS MAT. 416 STAINLESS STEEL OR EQUIVALENT CORROSION RESISTANT MATERIAL
SHAFT EXTENSION 416 STAINLESS STEEL OR EQUIVALENT CORROSION RESISTANT MATERIAL
Φ 15·55 ±0·03
SPACE RESERVED FOR SAND GUARD OR SEAL
13 MIN FULL SPLINE
FACE RUNOUT 0·03 INDICATOR READING
38·0 +0·3
25 MIN
25 MAX
4·0 +0·1
Φ 38·1 MAX
Φ 87·3 h8
ECCENTRICITY 0·05 INDICATOR READING
Φ 96 MAX
DIRECTION OF DOWN THRUST
ROTATION
R 25·5 MIN
Φ 76·2
25·5 MAX
SPACE FOR LEAD OUTLET
45°

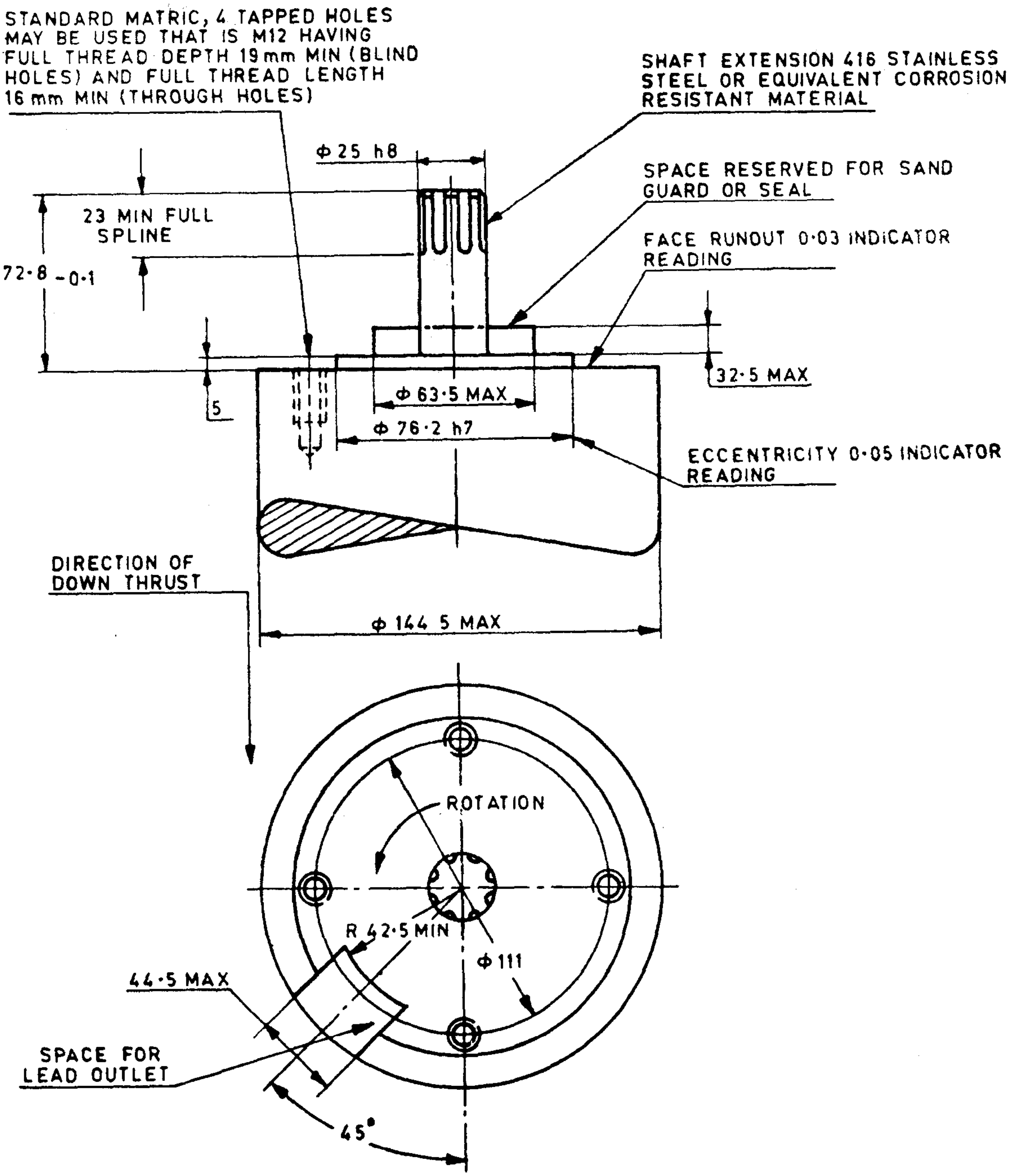
NOTES

1 Normal operating position of motor is vertical with shaft up.

2 For spline data Ref Fig. 7.

All dimensions in millimetres.

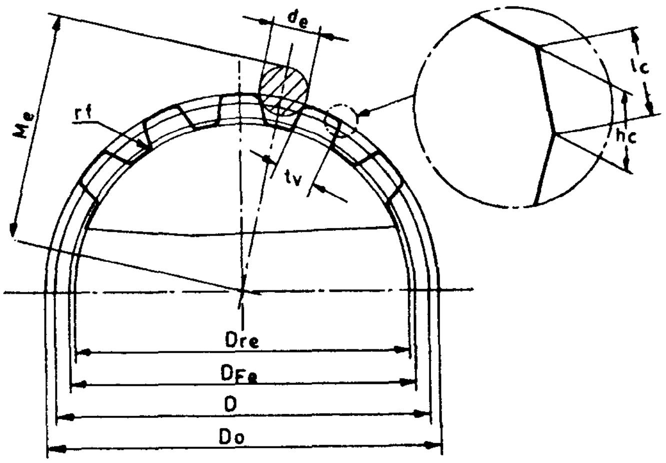
FIG. 5 END CONNECTION OF SUBMERSIBLE MOTOR FOR DEEP WELL PUMPS (100 mm BORE)


STANDARD MATRIC, 4 TAPPED HOLES MAY BE USED THAT IS M12 HAVING FULL THREAD DEPTH 19 mm MIN (BLIND HOLES) AND FULL THREAD LENGTH 16 mm MIN (THROUGH HOLES)
SHAFT EXTENSION 416 STAINLESS STEEL OR EQUIVALENT CORROSION RESISTANT MATERIAL
Φ 25 h8
SPACE RESERVED FOR SAND GUARD OR SEAL
23 MIN FULL SPLINE
FACE RUNOUT 0·03 INDICATOR READING
72·8 -0·1
32·5 MAX
5
Φ 63·5 MAX
Φ 76·2 h7
ECCENTRICITY 0·05 INDICATOR READING
DIRECTION OF DOWN THRUST
Φ 144 5 MAX
ROTATION
R 42·5 MIN
Φ 111
44·5 MAX
SPACE FOR LEAD OUTLET
45°

NOTE — Normal operating position of motor is vertical with shaft up for spline data Ref Fig. 7.

All dimensions in millimetres.

FIG. 6 END CONNECTION OF SUBMERSIBLE MOTORS FOR DEEP WELL PUMP (150 mm BORE)



SPLINE DATA

Description	Size of Motor	
	100 mm	150 mm
No. of teeth — N	14	15
Dimetrial pitch — P	24/48	16/32
Pressure angle	30°	30°
Base diameter — D_b	12·83	20·62
Pitch diameter — D	14·8 ± 0·1	23·8 ± 0·1
Major diameter — D_o	15·55 ± 0·03	25 h8
Form diameter — D_{Fe}	13·7 ± 0·1	22·1 ± 0·1
Minor diameter — D_{re}	13·3 ± 0·1	21·3 ± 0·1
Effective tooth thickness — t_v	1·62 ± 0·03	2·46 ± 0·03
Minimum measurement over pins — M_e	17·83 ± 0·02	28·25 ± 0·02
Pin diameter — d_e	2·03	3·05
Chamfer height — h_c	0·1	0·15
Chamfer length — l_c	0·2	0·3
Spline length — L *Min* (Effective)	13	23
Fillet radius — r_f	0·1	0·15
Maximum run-out	0·025	0·025
Maximum total indexing	0·033	0·038
Maximum involute flank form error	0·012	0·02
Maximum flank deflection distortion	0·008	0·013
Type of spline	Involute sided	Involute sided
Tolerance class	5	5

All dimensions in millimetres.

FIG. 7 SPLINE FOR SHAFT EXTENSION FOR SUBMERSIBLE MOTOR

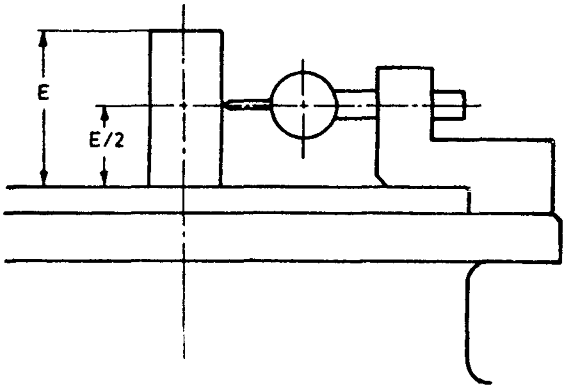


FIG. 8 MEASUREMENT OF SHAFT EXTENSION RUN-OUT

b) Length of the electric cable which is required for the submersible motor.

The complete information to be given with enquiry and order is given at Annex B.

15 RATING PLATE

15.1 The motor shall have the rating plate giving the following information:

a) Reference to this Indian Standard, that is Ref : IS 9283;
b) Induction motor;
c) Name of the manufacturer;
d) Manufacturer's number;
e) Type of duty;
f) Frequency in Hz;
g) Number of phases;
h) Rated output kW;
j) Rated voltage and winding connections;
k) Current, approximate, in amperes at rated output;
m) Speed in revolution per minute at rated output;
n) Minimum efficiency; and
p) Category of motor.

15.2 In addition, the manufacturer's serial number shall also be punched at a convenient place for easy identification.

15.3 BIS Certification Marking

The motor may also be marked with the Standard Mark.

15.3.1 The use of the Standard Mark is governed by the provisions of *the Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

16 CLASSIFICATION OF TESTS

16.1 Type Tests

The following shall constitute the type tests:

a) Insulation resistance test (both before and after the high voltage test);
b) High voltage test;
c) Measurement of stator resistance;
d) No load running of motor and reading of voltage, current, power input and speed;
e) Reduced voltage running up test at no load to check the ability of the motor to run upto full speed on no load in each direction of rotation with $1/\sqrt{3}$ of the rated voltage applied to the motor (for three phase motors only);
f) Locked rotor readings of voltage, current and torque of motors;

NOTE — This test may be made at a reduced. voltage, when a current at least equivalent to full load current is being taken by the motor.

g) Full load reading of voltage, current, power input and slip;

NOTE — Pump may be used as a loading device

h) Performance characteristics;
j) Temperature rise test;
k) Temperature rise test at a reduced voltage;
m) Momentary over load test; } upon agreement between the manufacturer and the purchaser
n) Vibration test; and } upon agreement between the manufacturer and the purchaser
p) Leakage current test at rated voltage.

NOTE — The recommended proforma for preparing a type test certificate is given in Annex C.

16.2 Routine Test

The following shall constitute the routine test;

a) Insulation resistance test (before high voltage test only);
b) High voltage test;
c) No load running of motor and reading of current and voltage;
d) Locked rotor reading of voltage, current and power input; and

Table 2 Values of Performance Characteristics of 2 Pole Three-Phase Submersible Motors

(*Clauses* 12.1 *and* 17.1)

Rated Output (kW)	Minimum Full Load Speed (rpm)	Maximum Full Load Current (A)	Minimum Starting Torque (In Terms of Percentage of Full Load Torque)	Nominal-efficiency (in Percent) of the Motors Suitable for Bore Size and Maximum OD (mm)		
				100 mm or 96 mm	150 mm or 142 mm	200 mm or 192 mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1·1	2 740	3·25	125	60	62·6	—
1·5	2 740	4·5	125	65·2	70·4	—
2·2	2 760	6·5	125	67·8	71·3	—
3	2 760	8·5	125	67·8	71·3	73·0
3·7	2 780	10·0	125	68·7	72·2	73·9
4·5	2 780	12·0	125	—	73·9	75·7
5·5	2 800	14·5	160	—	76·5	78·3
7·5	2 800	19·5	160	—	77·4	79·1
9·3	2 820	25·0	160	—	78·3	80·0
11	2 820	29·0	160	—	69·1	80·9
13	2 840	34·0	170	—	80·0	81·7
15	2 840	39·0	170	—	80·9	82·6

NOTE — For motors of output ratings below 1·1 kW and above 15 kW, the performance values shall be declared by the manufacturer.

NOTE — This test may be made at reduced voltage, when a current at least equivalent to full load current is being taken by the motor.

e) Reduced voltage running up test at no load to check the ability of the motor to run up to full speed on no load in each direction of rotation with $1/\sqrt{3}$ of the rated voltage applied to motor (for three phase motors only).

17 PERFORMANCE VALUES

17.1 Minimum full load speed, maximum full load current, minimum efficiency of 2 pole submersible motors suitable for 100 mm, 150 mm and 200 mm at rated voltage of 415 V and frequency of 50 Hz shall be in accordance with Table 2.

NOTES

1 For three phase motors, the value of the full load current shall be taken as the average value of the currents measured in the three phases.

2 For motors having rated voltage other than 415 V, values given in Table 2 shall be applicable except for value of maximum full load current which would be changed in the inverse proportion of the voltage.

3 In case the manufacturer declares superior nominal value of performance than specified in Table 2, declared values shall be subject to verification. The observed values of the performance characteristics obtained from the test results shall confirm to the declared values of the manufacturer within the tolerances specified in Table 3.

4 Performance value for 2 and 4 pole single phase motors and 4 pole three phase motors shall be declared by the manufacturer.

17.2 Tolerance

Unless otherwise specified, tolerance on performance shall be in accordance with Table 3. Where a tolerance is stated in the other direction, is considered unimportant.

Table 3 Schedule of Tolerances

(*Clauses* 17.1 *and* 17.2)

Item	Tolerances
Efficiency	
a) By summation of losses:	
Motors up to 50 kW	− 15 percent of ($1-\eta$)
Motors above 50 kW	− 10 percent of ($1-\eta$)
b) By input-output test	− 15 percent of ($1-\eta$)
Losses	
Total losses applicable to motors above 50 kW	+ 10 percent of the total losses declared
Power Factor	− 1/6 of (1 − Cos ϕ) *Min* 0·02, and *Max* 0·07
Slip	
Slip at full load and at working temperature	+ 20 percent of guaranteed slip

η = declared value of efficiency, and

Cos ϕ = declared value of power factor.

18 OVERLOAD TEST

18.1 Momentary Excess Torque

The motor shall, whatever their type of construction, be capable of withstanding for 10 s without stalling or abrupt change in speed (under gradual increase of torque) an excess torque of 60 percent of the rated torque the voltage and frequency being maintained at their rated value.

18.2 Sustained Overloads

Motors rated in accordance with this standard are not capable of carrying sustained overloads.

19 TEMPERATURE RISE TEST

19.1 The temperature rise test of the motor at rated voltage and supply frequency shall be carried out with the motor coupled to a suitable pump for the maximum current in the operating head range and the set run continuously for 2 h in this condition. The set is stopped and the temperature rise of the stator winding computed by the resistance method shall not exceed 35°C at rated voltage and 45°C at 85 percent of the rated voltage. During the test the temperature of the cooling water may not exceed 45°C.

19.2 Determination of Temperature Rise of Winding by Resistance Method

The temperature rise ($t_2 - t_1$) may be obtained from the ratio of the resistance by the formula:

$$\frac{t_2 + 235}{t_1 + 235} = \frac{R_2}{R_1}$$

where

t_2 = Temperature (°C) of the winding at the end of the test;

R_2 = Resistance of the winding at the end of the test measured within 30 s after shut down;

t_1 = Temperature (°C) of the winding (cold) at the moment of the intial resistance measurement; and

R_1 = Initial resistance of the winding (cold).

For practical purpose the following alternative formula may be found convenient:

$$t_2 - t_a = \frac{R_2 - R_1}{R_1} (235 + t_1) + (t_1 - t_a)$$

where

t_a = temperature (°C) of cooling medium at the end of the test.

20 HIGH VOLTAGE TEST

20.1 The high voltage test shall be applied between the windings and the frame or pipe with the cover connected to the frame and to the windings not under test, and shall be applied only to a new and completed motor with all of its parts in place under conditions equivalent to normal assembled conditions, filled with water and motor surrounded by water. The test shall be carried out at the conclusion of the temperature rise test of the motor where such a test is carried out.

20.2 The test voltage shall be of power frequency and shall be as near as possible to sine wave form. The test shall be commenced at a voltage of not more than one half of the full test voltage. The voltage shall then be increased to the full value steadily or in the steps of not more than 5 percent of the full value, the time allowed for the increase of the voltage from half to full value being not less than 10 s. The full test voltage of 1 500 V shall be maintained for 30 s.

20.3 During the routine testing of motors of rated output up to and including 5 kW, the 30 s test may be replaced by a test of approximately 5 s at the normal test voltage given in **20.2**.

20.4 Since the test is already made on the windings for acceptance shall, as far as possible, not be repeated. If, however, a second test is made at the special request of the purchaser/laboratory, after further drying, if considered necessary, the test voltage shall be 80 percent of the voltage given in **20.2**.

NOTE — The HV tester shall have adequate capacity to carry the leakage current of the motor.

21 INSULATION RESISTANCE TEST

21.1 The insulation resistance when the high voltage test is applied shall be not less than one megohm. The insulation resistance shall be measured with a dc voltage of 500 V applied for a sufficient time for the reading of the indicator to become practically steady, such voltage being taken from an independent source or generated in the measuring instrument.

22 SPEED

22.1 The speed measurement may be conveniently taken by means of a slip coil or any other suitable method.

23 LEAKAGE CURRENT TEST

23.1 The maximum leakage current value shall be declared by the manufacturer at rated voltage.

NOTE — For safety purpose it shall be ensured during installation that the earthing is capable of taking care of leakage current.

ANNEX A

(*Clause* 2 1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
210 : 1993	Grey iron castings (*fourth revision*)
318 : 1981	Leaded tin bronze ingots and castings (*second revision*)
325 : 1978	Three-phase induction motors (*fourth revision*)
613 : 1984	Copper rods and bars for electrical purposes (*second revision*)
648 : 1994	Non-oriented electrical steel sheets and strips for magnetic circuits
694 : 1990	PVC insulated cables for working voltages up to and including 1 100 V (*third revision*)
996 : 1979	Single-phase small ac and universal electric motors (*second revision*)
1570 (Part 5) : 1985	Schedules for wrought steels : Part 5 Stainless and heat-resisting steels (*second revision*)
1873 : 1961	Thinner, antichill for cellulose nitrate based paints, dopes and lacquers for aircrafts
1885 (Part 35) : 1973	Electrotechnical vocabulary: Part 35 Rotating machinery
2223 : 1983	Dimensions of flange mounted ac induction motors (*first revision*)
3043 : 1987	Code of practice for earthing (*first revision*)
3073 : 1967	Assessment of surface roughness
4029 : 1967	Guide for testing three-phase induction motors
4800 (Part 7) : 1970	Enamelled round winding wires : Part 7 Wires with good dielectric properties under humid conditions
7538 : 1975	Three-phase squirrel cage induction motors for centrifugal pumps for agricultural pumps
7572 : 1974	Guide for testing single-phase ac and universal motors
8034 : 1989	Submersible pumpsets (*first revision*)
8783 : 1978	PVC insulated winding wires for submersible motors
10804 : 1994	Recommended pumping system for agricultural purposes (*second revision*)
11723 (Part 1) : 1992	Mechanical vibration — Balance quality requirements of rigid rotors : Part 1 Determination of permissible residual unbalance (*first revision*)
12360 : 1988	Voltage bands for electrical installations including preferred voltages and frequency
12824 : 1989	Types of duty and classes of ratings assigned to rotating electrical machines
14220 : 1994	Openwell submersible pumpsets

ANNEX B

(*Clause* 14.1)

INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

1. Site and operating conditions
2. Reference to this standard, that is Ref IS 9283
3. Diameter of the bore
4. Level of water above the submersible motor
5. Length of cable which is required for the submersible motor
6. The type of duty
7. Frequency in Hz
8. Number of phases
9. Mechanical output in kW
10. Rated voltage and permitted variation
11. Speed in revolutions per minute, approximate, at the rated output
12. If a motor is required to operate between various limits of voltage, current, frequency or speed, the corresponding value of the voltage, current, frequency or speed, respectively
13. System of earthing, if any, to be adopted
14. Particulars of tests required and where they are to be carried out
15. Method of starting to be employed.

ANNEX C

(*Clause* 16.1)

FORM FOR TEST REPORT OF MOTORS FOR SUBMERSIBLE PUMPSETS

Name and address of the manufacturer ____________________

Purchaser ____________________ Certificate No. ____________________

Purchase Order No. ____________________ Order Acceptance No. ____________________

NAME PLATE DATA

Motor Sl No.

Output .. ...kW

Speed.........rpm

Duty Type...... ...

Voltage ..... volts

Frequency..... Hz.

Current.........amp.

Bore well size .... mm.

TEST CHARACTERISTICS

Loading Condition	Volts V	Amps A	Watts kW	Load	Slip Percentage	Power Factor	Efficiency
No load							
				1/2			
				3/4			
Full load				1/1			

TEMPERATURE RISE TEST

	Condition of Test			Watts Input kW	Calculated Output kW	Temperature Rise °C
	Hours Run h	Line Voltage V	Line Current A			
At rated volts						
At 85 percent of the rated volts						

BREAKAWAY TORQUE AND STARTING CURRENT

Breakaway Torque (Locked Rotor) with Volts Applied	V........ .... kg.m	Breakaway Starting Current and Power Input (Locked Rotor) with Volts Applied	V........ W........ A........ ....kg.m

Insulation resistance test	....	Megohm
High voltage test	....	Volts for 30 s
Resistance of winding	....	ohms
Momentary overload	....	15 s

Test conducted on Motor No. .... Approved by

Tested by: on: Date:

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AMENDMENT NO. 1 APRIL 1997
TO
IS 9283 : 1995 MOTORS FOR SUBMERSIBLE PUMPSETS — SPECIFICATION

(*First Revision*)

[*Page* 11, *clause* 15.1(n)] — Substitute 'Nominal efficiency' *for* 'Minimum efficiency'.

(*Page* 12, *clause* 17.1, *line* 2) — Substitute 'nominal efficiency' *for* 'minimum efficiency'.

(*Page* 12, *Table* 2, *col* 6) — Substitute '79.1' *for* '69.1'.

(ET 15)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 MAY 2002
TO
IS 9283 : 1995 MOTORS FOR SUBMERSIBLE PUMPSETS — SPECIFICATION

(*First Revision*)

(*Page* 1, *clause* **4.1**, *Note* 1) — Delete.

(*Page* 1, *clause* **5.1.3**, *line* 2) — Delete 'pure'.

(*Page* 11, *clause* **16.1**, *Note*) — Insert Note 2 as given below and renumber the existing Note as 'Note 1':

> 'NOTE 2 — Due to typical construction of motors for submersible pump sets, the vibration test may not be performed on the actual machine. However, manufacturer shall certify that the rotating parts are properly balanced before assembly and will stand guarantee if vibration problems are faced after installation.'

(ET 15)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 APRIL 2006
TO
IS 9283 : 1995 MOTORS FOR SUBMERSIBLE PUMPSETS — SPECIFICATION

(First Revision)

(*Page* 13, *clause* **19.1**) — Insert the following Note at the end:

"NOTE — Temperature-rise test at 85 percent of rated voltage is not applicable for category 'A' motor."

(ET 15)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 AUGUST 2011
TO
IS 9283 : 1995 MOTORS FOR SUBMERSIBLE PUMPSETS — SPECIFICATION

(First Revision)

[*Page* 1, *clause* **5.1.3** (*see also Amendment No.* 2)] — Substitute the following for the existing clause:

‘The thrust bearing housing shall be provided with a drain plug to empty the water filled into the thrust bearing housing/motor and in the wet type oil filled motor external plug shall be provided to empty the oil filled in the motor.’

(ET 15)

Reprography Unit, BIS, New Delhi, India